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# AGRICULTURAL Research

*April/1962*

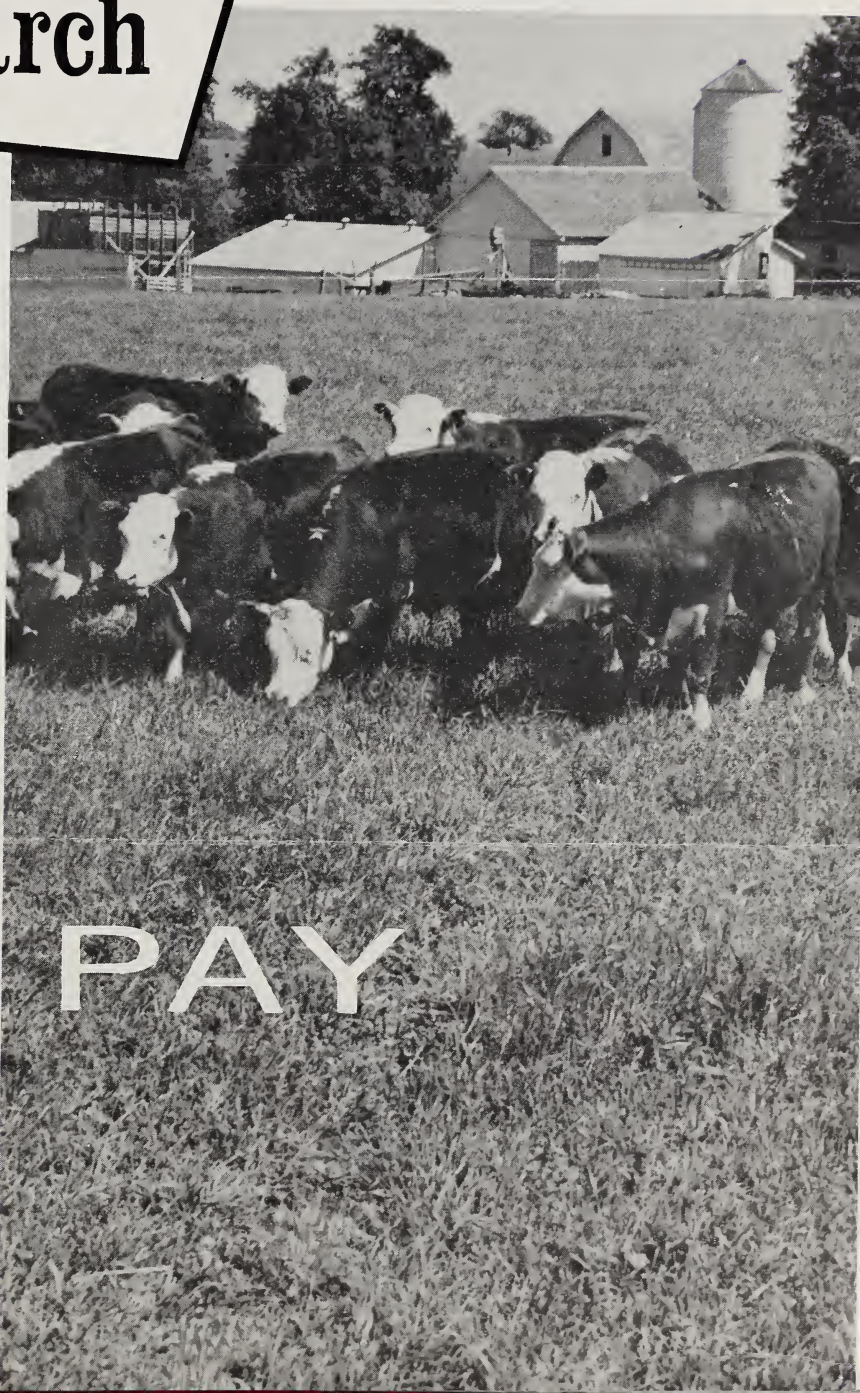


## *Small- Grain Pastures*

# PAY

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*United States  
Department of  
Agriculture*



# AGRICULTURAL Research

April 1962/Volume 10, No. 10

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## The Morrill Act

The hundredth anniversary of two significant events in the history of U.S. agriculture are being observed this year.

One is the centennial of USDA, about which we have already commented on this page. The other is the hundredth anniversary of the Morrill Act, which established the land-grant concept of higher education.

President Lincoln's signing of the Morrill Act, July 2, 1862, probably did more to increase college-level educational opportunities in the U.S. than any event before or since.

The Morrill Act, named for Justin Morrill, a 43-year veteran of Congress from Vermont, provided that every State should receive Federal lands on the basis of 30,000 acres for each of its congressmen. Income from this land was to be used to endow, support, and maintain "at least one college where the leading object shall be, without excluding other scientific and classical studies, to teach agriculture and mechanic arts to promote the liberal and practical education of the industrial classes."

By 1870, 47 States had taken steps to establish this new type of college. Today, there is at least one land-grant institution in every State, and 20 percent of all college students in the U.S. attend them.

In addition to offering educational opportunities, the land-grant colleges and universities have been leaders in bringing science into the curricula. They have developed scientific talent that has spilled over from agriculture into every area of endeavor. Through the land-grant system, large bodies of scientific facts have been discovered and put to use.

Land-grant institutions also get much of the credit for agriculture's ability to produce abundantly and efficiently. Their contributions aren't limited to our borders. Our efforts to develop an international understanding of the land-grant system has been one of America's greatest contributions to world-wide education.

Many of today's challenges, however, dwarf those of a century ago. Teaching, research, and extension, as provided by the land-grant institutions and USDA, continue to provide leadership for the world's agricultural progress.

AGRICULTURAL RESEARCH is published monthly by the Agricultural Research Service, United States Department of Agriculture, Washington 25, D.C. Printing has been approved by the Bureau of the Budget, August 15, 1958. Yearly subscription rate is \$1 in the U.S. and countries of the Postal Union, \$1.50 in other countries. Single copies are 15 cents each. Subscription orders should be sent to Superintendent of Documents, Government Printing Office, Washington 25, D.C.



Growth Through Agricultural Progress

**AGRICULTURAL RESEARCH SERVICE**  
**United States Department of Agriculture**

✓

Laboratory studies confirm theories  
about how insects resist . . .

# INSECTICIDES

*Enzyme changes are involved in the ability  
of some insect pests to develop resistance to  
the organophosphate family of chemicals*

■ In laboratory experiments, USDA entomologists have overcome the resistance of some insects to malathion by combining it with a synergist—a chemical that restores malathion's toxicity but is nontoxic itself. Equally important, they know *why* this chemical combination proved effective.

Specifically, F. W. Plapp and G. W. Eddy of Corvallis, Oreg., killed malathion-resistant houseflies and mosquitoes by treating them with malathion combined with certain other phosphorous compounds.

Results of this research confirm theories the scientists based on previous studies—some by them and some by other scientists. Previous research had shown:

- Malathion (and other organophosphate insecticides) is toxic to susceptible insects, because it inhibits the activity of a vital enzyme, ali-esterase.
- Resistant insects detoxify organophosphorus insecticides more rapidly than susceptible insects. There is less ali-esterase in the resistant insects. This ali-esterase is changed to a new enzyme, enabling the detoxification.

On the basis of this knowledge, selective materials were tested in combination with malathion in an effort to block the physiological mechanism that gives insects resistance.

The chemicals Plapp and Eddy used were tri-substituted aromatic and aliphatic derivatives of phosphoric acid. The materials produced the hoped for synergistic action in the insects by inhibiting the ali-esterase enzyme. Three of the most effective synergists used were triphenyl phosphate, tributyl phosphorotrithioate, and tributyl phosphorotrithioite—compounds in the same chemical family as malathion, but which alone are not effective insecticides.

For their studies the scientists used adult female houseflies and mosquito larvae. Malathion-resistant and susceptible colonies of each species were used.

*Turn Page*

## INSECTICIDES

(Continued)

Groups of 20 adult female flies were exposed to films of the insecticide with or without synergist in 1-pint glass jars. Mosquito larvae were tested by placing groups of 20 in 250 milliliters of water in glass jars containing toxicants.

In all tests, mortality determinations were made 24 hours after initial exposure to the toxicant.

The synergists either greatly reduced or completely overcame resistance. None of them significantly increased toxicity of malathion to susceptible insects.

Still not fully understood is the exact process by which the synergists work. Plapp and Eddy say the most logical explanation is that the synergists inhibit the ability of the insects to degrade malathion by cleavage of the carboethoxy ester linkages. Both houseflies and mosquitoes are known to degrade malathion partially through hydrolysis at these bonds. And with one species of mosquito, *Culex tarsalis*, increased ability to degrade by hydrolysis of the carboethoxy ester is known to be a factor in resistance to malathion.

On the basis of preliminary results, the entomologists hope their findings will lead to a better understanding of the mode of action of insecticides and the factors involved in the development of resistance in insects. A better understanding of these basic questions may lead to more effective materials or combinations of them for controlling resistant as well as nonresistant insects.

The ARS scientists are still concerned with research on the basic mechanisms involved and with a search for more promising materials. Further investigations will be required to determine the potentialities of these materials in insect control. ☆



Fourth in a Centennial Series

*Tourists' baggage, a favorite hideaway for hitch-hiking agricultural pests, gets quarantine inspection.*



*Efforts to keep most destructive insects and diseases out of the U.S. have been successful, even though travel and transportation are increasing*

■ The *Mayflower* probably carried many more insects than humans. And so did other ships carrying early American settlers.

These people brought with them such parasitic insects as lice, fleas, and bed bugs—fabric pests such as clothes moths and carpet beetles—and houseflies, ants, and cockroaches.

That was only the beginning of North America's invasion by insect pests and plant diseases. This invasion continued, and through the 1800's until 1912 the U.S.



*Inspectors in 1928 board Graf Zeppelin to look for farm pests during early days of air travel.*

*From 1900 to 1930, hopper dozers caught many a grasshopper—and missed many—on Western ranges.*



*Fumigation of stored grain under cover is ridding U.S. of khapra beetle, a tiny, hard-to-kill foreign grain pest.*



*Now insecticide from airplane treats 1,000 acres an hour.*



# PESTS

was a dumping ground for refuse nursery stock. At least half this country's destructive insects had entered from other countries by the time the Plant Quarantine Act of 1912 was passed.

Since passage of this act and the development of port-of-entry plant-quarantine inspection, the flow of foreign pests has been stemmed despite ever-increasing international transportation and travel. Some pests still gain entry, but thousands are kept out.

Today, plant quarantine inspectors intercept a plant pest every 20 minutes. Pests can enter not only via seaports and borders, but also through the new St. Lawrence Seaway and the Great Lakes, which reach into the richest of American farmlands. By jet and other aircraft, nonstop from Europe, from Asia, and across the polar icecap, insects travel in air-conditioned comfort toward the U.S. A particular danger is that insects can be carried in the luggage of world travelers.

If a pest gets by the quarantine inspectors, additional kinds of protection are used: *early detection*; *surveys* to pinpoint areas where a pest is established; *quarantines* to prevent spread; *control* to preclude damage; and, when possible, *eradication*.

Organized efforts to control plant pests were made before quarantine legislation was passed. In 1877, Congress appointed a commission to study grasshopper

and other serious insect infestations, and by 1893, the first insect-pest survey was undertaken. In 1918, toxic dust was dumped over the side of an airplane to kill pink bollworms. This was the first use of aircraft in a pest-control effort.

Several plant pests have been eradicated from the U.S. These include parlatoria date scale, citrus blackfly, citrus canker, Mediterranean fruitfly, Hall scale, and hoja blanca of rice. The outlook is good for eradication of others—such as the khapra beetle, witchweed, and golden nematode. Federal-State efforts have checked spread of the pink bollworm, Mexican fruitfly, gypsy moth, white-fringed beetle, and Japanese beetle, thus preventing much damage by these insects.

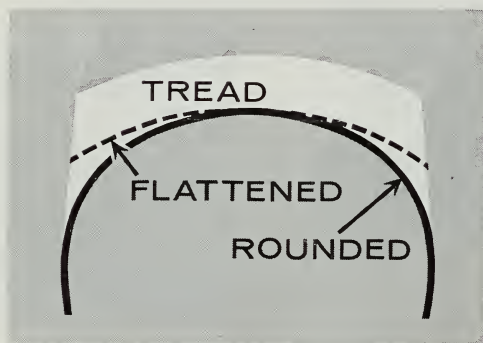
While the use of chemicals against crop, animal, household, and human pests grew steadily, the public had no Federal protection against fraudulent, ineffective, and unsafe insecticides and fungicides—until the Department-sponsored Insecticide Act of 1910 became law. Such protection was broadened in 1947, 1959, and 1962 as new chemicals came into use.

The Federal Insecticide, Fungicide, and Rodenticide Act now requires registration, testing, and proper labeling of more than 50,000 pest-control products shipped interstate for household, institutional, structural, and agricultural uses. ☆

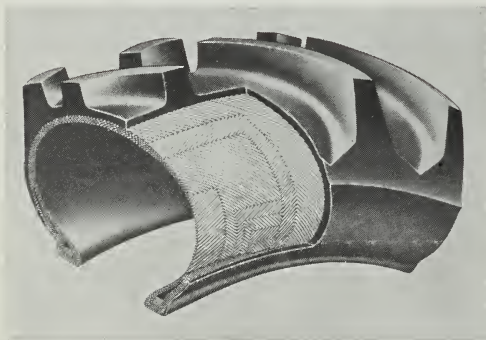
More Traction and Efficiency from

# NEW TIRE

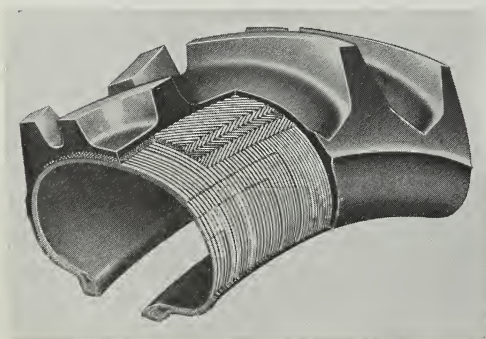
*Researchers believe a more stable casing, flattened tread base, narrow rim width all contributed to better overall performance than from conventional tire*



*Flattened tread base (dashes) of the radial-ply tire distributes weight more evenly than conventional rounded base.*



*Fabric cords in the conventional tire (top) are in diagonal layers. But cords in radial-ply tire (bottom) are in parallel layers. Experimental tire performed best.*



■ An experimental tractor tire—so smooth it resembles an inner tube—outperformed a conventional tractor tire by 40 percent under average conditions in tests conducted at USDA's National Tillage Machinery Laboratory, Auburn, Ala.

The smooth tire was 14 percent more efficient in converting axle power into drawbar power.

The absence of lugs and differences in internal construction contributed to the tire's improved performance, researchers believe.

Cords in the experimental tire casing are parallel across the tire (radial-ply construction), rather than in alternating diagonal layers as in conventional casings. The tread base of the tire is flatter than the round, nearly circular tread base of a conventional tire, and the rim width is narrow (3½ inches). Rim widths of conventional tires range between 8 and 15 inches.

ARS agricultural engineers G. E. Vanden Berg and I. F. Reed do not

# Bonus from Chemical Sterilants



know why these factors boosted traction, but they have some ideas. They think that because the radial-ply tire casing is more stable than a conventional casing, there is more uniform contact with the soil. They also believe a flattened tread base and narrow rim width produce a tire that distributes weight more evenly over the soil than the base and rim width of a conventional tire.

In one test on firm soil, a tire with radial-ply, narrow rim, flattened tread base, and lugs performed 27 percent better than a standard tractor tire of the same size. When a similar tire was made smooth by buffing off the lugs, its performance increased 41 percent over the standard tire with lugs.

All tests were made in bins of four soil types and on concrete. Only traction was evaluated, not wear or cost.

## Lugs are needed on slick surfaces

According to the engineers, lugs are essential for pulling on slick surfaces such as heavy grass, straw mulch, or mud. But lugs as big as those on conventional tires may not be necessary for general farm use.

If similar findings are made in additional research, Vanden Berg and Reed believe the tractor tire of the future will feature radial-ply construction, flattened tread base, narrow rims, and modified lugs for optimum traction in both routine and heavy pulling.☆

■ In studying means of producing sterility in insects, USDA entomologists are finding that chemical sterilants may offer an unexpected bonus—male houseflies treated with a chemical sterilant are unusually vigorous and competitive in mating with females.

Maintenance of vigor and competitiveness of sterilized males is essential for maximum results in insect control by sterilization, because wild females that mate with sterile males lay eggs that do not hatch. Thus, the more successfully sterilized males compete with wild males in mating, the more effective is the sterilization method.

In tests at Orlando, Fla., the chemosterilant apholate resulted in exceptional competitiveness of treated males.

Scientists had noted in earlier work that gamma radiation—the other method of producing insect sterility—tends to injure and weaken insects. Insects injured by irradiation are neither as long-lived nor as vigorous and competitive as normal insects.

The entomologists determined competitiveness of chemosterilized males—and thereby effectiveness of the treatment—by caging untreated females at various ratios with sterile and normal males and recording the hatch of the eggs. Theoretically, if the treated and untreated males were equally competitive, a ratio of ten sterile males to one untreated male and one untreated female (10:1:1) should result in 91 percent reduction in egg hatch.

Results with apholate actually exceeded theoretical expectations. At the ratio of 10:1:1, and at four other ratios down to 1:1:1, reduction of hatch was always more than expected. One hatch reduction was 25 percent more than the theoretical expectation.

ARS entomologists G. C. LaBrecque, D. W. Meifert, and C. N. Smith conducted the research in cooperation with the Department of Defense, through the Armed Forces Pest Control Board. To sterilize the flies chemically, the scientists incorporated 1 percent apholate in the food of male flies for 3 days after emergence as adults. They also irradiated some flies by exposing the pupae to 2,500 roentgens of gamma radiation. The irradiated male flies were not as competitive as normal males, since the reduction in egg hatch was less than the theoretical expectation.

The tests are being conducted to develop chemosterilant treatments, using the housefly as a test insect. Objective of the research is to obtain basic information about chemosterilants.

Much additional research will be needed before practical control of insects can be achieved by chemosterilant applications.☆



# ALLIGATORWEED...

## **controlled by Insects ?**

*A flea beetle, a stem borer,  
and a species of thrips seemed  
most promising in first tests*

■ South American insects that feed on alligatorweed may aid in controlling this aquatic plant that often clogs lakes, irrigation ditches, rivers, and ponds in the Southeastern U.S.

ARS entomologist G. B. Vogt found the insects in 1960 and 1961, while searching for insect enemies of alligatorweed in Argentina, Paraguay, and Brazil. (Vogt was aided by scientists of South American governmental organizations, museums, and universities.) About 2 years' work will probably be required to determine whether any of the insects can be safely brought to the U.S.

Alligatorweed and water-hyacinth (ACR. RES., February 1962, p. 15) are the worst aquatic weeds in the Southeast. These weeds interfere with agriculture, fish-

*A saw-boat chops alligatorweed and water-hyacinth choking a southern U.S. waterway. This sometimes spreads aquatic weeds.*

eries, recreation, movement of traffic on navigable waterways, and hydroelectric power production. The weeds also can endanger public health by creating mosquito-breeding places.

Insects that eat alligatorweed help to control it in South America. But in the U.S., where the weed gained a foothold about a century ago, the plant has no important natural enemies.

Three of the insects—a flea beetle, a stem borer, and a species of thrips—are most promising for suppressing alligatorweed in this country. In all, Vogt collected more than 300 specimens of alligatorweed and closely related plants and 40 to 50 kinds of insects that feed on them.

#### Entomologist will determine if insects can be brought to U.S.

But can these insects be safely and successfully introduced into this country? ARS entomologist D. M. Maddox will conduct intensive tests in Argentina to answer the question. His laboratory is being set up in connection with the Argentina Experiment Station near Buenos Aires. The U.S. Army Corps of Engineers, which is responsible for maintaining navigable waterways in the U.S., will help to finance this research.

He will first concentrate his research on the flea beetle, because it is most promising of the insects. He will make feeding tests on many U.S. crops and plants to be sure the flea beetle attacks none of value. Buckwheat and rhubarb are among the cultivated plants most closely related to alligatorweed. In Vogt's preliminary tests, flea beetles starved to death on buckwheat and rhubarb.

Two flea beetle parasites—a fungus and a small fly—reduce beetle populations in South America. Maddox plans to isolate the parasites from beetle colonies that may be introduced into the U.S.

He may also have to adjust the flea beetle's life cycle to U.S. seasons, which are opposite those in South America.

Maddox may need to explore farther into northern South America to obtain more tropical insects for the warm Gulf region and Florida. ☆



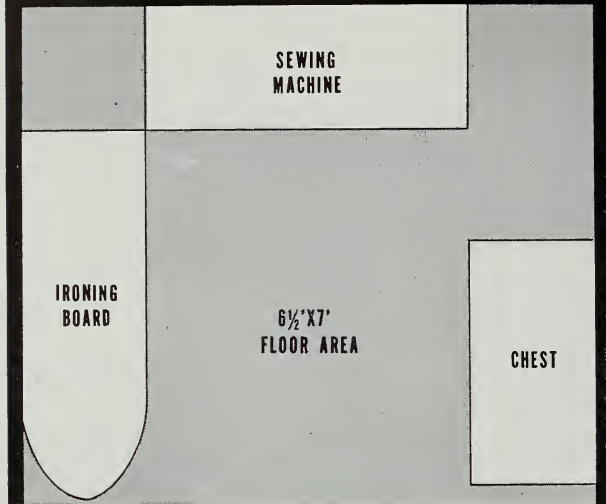
*South American flea beetle *Agasicles connexa* might kill more alligatorweed here than chemicals or machines do.*



*Flea beetles starved when scientist in Argentina confined them to buckwheat (plastic bags), but they thrived on alligatorweed (rear).*

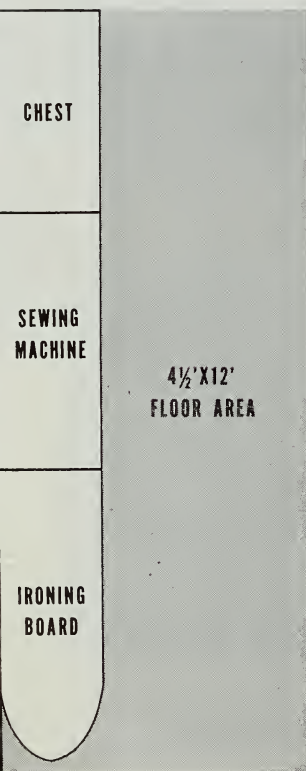
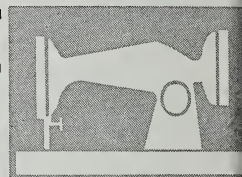


*Stem borer that damaged this alligatorweed in South America might do the same in U.S.*

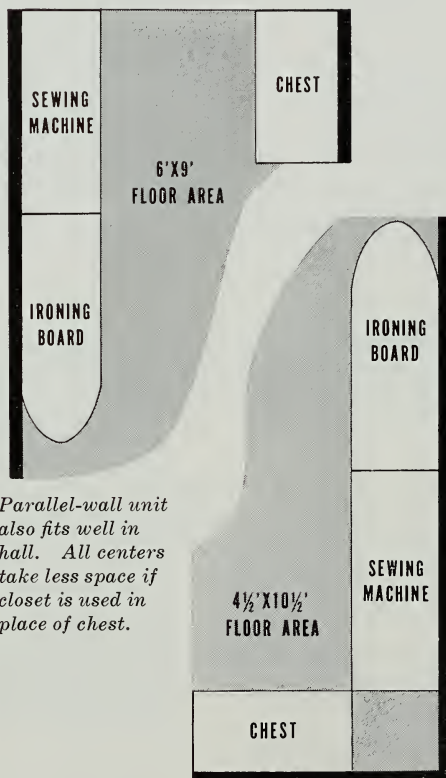


*U-shape center was most easily used by homemakers who tested the unit.*

# CONVENIENT HOME SEWING CENTERS



*One-wall unit is best suited for being set up in a hallway.*



*Parallel-wall unit also fits well in hall. All centers take less space if closet is used in place of chest.*

*Cabinet and machine are at right angles for easy reach in L-shape.*

*Use of these areas, set up for efficiency, can aid in saving time and energy, and in avoiding strain*

**S**EWING has been reported as a household activity by three-fourths of the rural homemakers in regional housing surveys by State experiment station and USDA researchers.

In the South, some families reported making as many as 60 garments a year. The latest nationwide USDA survey shows that 40 percent of all women make clothes for themselves and their families. Nearly 70 percent use a sewing machine to make or mend clothes or household articles.

The surveys also show that home sewing is done in many parts of the house. Typically, a homemaker cuts out a garment on the dining table, presses on an ironing board in the kitchen or laundry, and sews in a bedroom. Work often must be done at an uncomfortable height or angle or in poor light.

■ Space for sewing, probably the most disorganized of household jobs, receives scant attention from architects and home builders. Yet several USDA surveys show the need in most homes for a place planned especially for sewing.

A compact sewing center is needed particularly in today's small house. Now there are four such centers—U-shape, L-shape, or with parallel-wall or one-wall arrangements. These centers were designed and tested at the Georgia Agricultural Experiment Station in the latest of three regional studies with ARS.

Plans for the centers are based on surveys of what homemakers use in sewing, on measurements of space needed for different sewing jobs, and on tests of various working heights and arrangements for storage of supplies. Aim of the research is to help homemakers save time and energy and avoid strain when sewing.

In each center, equipment and supplies for usual sewing are arranged at comfortable working heights and within easy reach of a seated person.

#### **Least space needed for U-shape center**

Of the four designs, the U-shape center requires the least floor space and proved most convenient when tried by homemakers cooperating in the studies. Minimum floor space used for this center was 6½ by 7 feet. But the L-shape arrangement (minimum 4½ by 10½ feet) may fit the corner of a room better. The parallel-wall (6 by 9 feet) center or the one-wall (4½ by 12 feet) center are best for a hallway.

Any of these arrangements can take up less floor space if the center adjoins a closet that can be used instead of a chest for storing supplies.

The U-shape center groups ironing board, sewing machine, and supply chest on three sides of a sewing chair. A movable chair on casters enables

the homemaker to reach sewing supplies and even do some pressing without standing.

The studies show that homemakers need at least 2 feet of space in front of the ironing board, sewing machine, and supply chest for comfortable work. They need 2 feet of working space on all sides of the cutting surface for greatest convenience in cutting out garments.

Most of the homemakers found that the most convenient height for cutting out garments was 36 inches

from the floor. Space needed for this job was 3 by 4 to 6 feet.

Sewing centers designed are described and illustrated in detail in "Home Sewing Areas," an 8-page leaflet that is free on request from the School of Home Economics, University of Georgia, Athens, Ga. The drawings are easy for a homemaker to use in setting up her own sewing center. The leaflet may be useful to anyone who is planning a house for convenience, comfort, and efficiency.☆

### **Extra-Attractive Easter Lilies**

■ Many Easter lilies grown for the 1962 market will have exceptionally attractive flowers and foliage, because the bulbs from which they grew were treated with a systemic insecticide—phorate or Di-Syston.

While evaluating these two systemics for insect control, ARS entomologist C. F. Doucette discovered that they also stimulate growth. (A systemic insecticide is absorbed by plants and then poisons certain insects that feed on them.) Doucette cooperated with the Oregon Agricultural Experiment Station and commercial lily bulb growers near Brookings, Ore.

In the tests, granules of phorate or Di-Syston were applied to bulbs planted in the field in the fall of 1958. The bulbs were harvested a year later, and some were forced (stimulated artificially) in commercial greenhouses to produce plants for the 1960 market.

Doucette noted that plants grown from the treated bulbs had more flowers, more attractive foliage, and more highly developed root systems than could be attributed to control of pests known to be affected by the systemics. Doucette concluded that the systemics controlled some unknown pests or brought about direct stimulation of plant development.

Phorate and Di-Syston were subsequently registered by USDA for commercial growers to use as insecticides. Some plants on the 1961 market were forced from treated bulbs. Use of the chemicals was widespread for the first time on bulbs planted in 1960 to produce plants this year.

Phorate or Di-Syston is applied to the bulbs after they are set in the field, but before they are covered with soil. These insecticides are toxic and should be used only by commercial growers who are familiar with handling such chemicals.☆

# Small-Grain Pastures **PAY**

■ Fatten steers on small-grain pastures? Georgia-USDA researchers have studied this practice for more than 10 years and say it pays.

They found that small-grain pastures can be utilized best by combining grazing and drylot feeding. This resulted in lower feed costs than did feedlot-only fattening. Animals fattened on pastures and in the feedlot gained as fast or faster, and their finish grades equalled those of animals fattened only in the feedlot.

In one of the most successful combinations of grazing and drylot feeding, yearling steers were feedlot-fattened 76 days, then switched to oat pasture for 71 days. Average daily gain was 2.4 pounds, compared with 2.1 pounds of gain for steers kept in the feedlot the whole time. Estimated feed costs per 100 pounds of gain were \$20.25 for the steers fattened and grazed, and \$24.00 for those kept in the feedlot. Both groups' slaughter grades averaged good.

Feedlot rations consisted of about 70 percent ground snapped corn, 10 percent cottonseed meal, and 20 percent coastal bermudagrass hay. Steers grazing oats were each given about 10 pounds of ground snapped corn daily.

Switching from pasture to feedlot also worked well. In one trial, two groups of steers were started on a maintenance feeding program for 76 days, to allow time for the pastures to get in grazing condition. The animals received coastal bermudagrass hay during this period and later when they were put on pasture. One group grazed oat pasture 112 days, then was in the feedlot 35 days. The other was in rye pasture 98 days, then spent 49 days in the feedlot.

Steers in each group averaged about 2.4 pounds of daily

gain and graded good. Feed costs were about \$18.50 per 100 pounds of gain for steers that grazed oats and \$22.00 for those that grazed rye.

The oats made better grazing than rye in this experiment. But the scientists suggest an oat-rye crop rotation system instead of continuous oat plantings. Rotation planting will reduce chances of plant diseases ruining the oats.

In these feedlot-and-grazing experiments, the cattle utilized the complete growth of forage, so that no grain could be harvested.

The study was conducted by Georgia animal husbandmen W. C. McCormick and D. W. Beardsley, and ARS-Georgia animal husbandman B. L. Southwell at the Georgia Coastal Plain Experiment Station, Tifton.

Results of these experiments confirm those of earlier studies, which also showed that:

- Animals fattened only on grain pasture make less daily gain and produce lower-grade carcasses than animals fattened in feedlots. Feeding costs are lower, however, for steers on pasture.

- Oats grazed for a limited time can provide a substantial amount of grain for harvest. Steers grazed about 70 days in each of 3 years in a test. The steers were removed (about the first of March) before the oats headed. Average annual grain yield was 33 bushels an acre—including a low 10-bushel yield the third year, due to an oat disease.

The scientists say oats planted only for grazing should be seeded about twice as heavily and fertilized more liberally than oats planted for grain. Thick planting and limited grazing, though, may result in good grain yields. ☆

## PARASITES COMPETE OR COOPERATE

■ Some internal parasites of livestock apparently compete with each other for survival, in addition to feeding on their hosts, while other species live together peacefully.

A recent USDA study of what happens to populations of three different species of stomach worms in lambs

was designed to provide more information about this compete-or-cooperate phenomenon. Scientists are conducting such research so they can more accurately interpret results of livestock parasite investigations.

Usually, experiments are designed to show what one kind of parasite will

do to an animal. These studies are valuable—they show how a parasite species reacts to drug treatment, for instance. But results can be misleading. An animal may be naturally infested with several species of parasites at the same time, and may not respond as expected to medication.

In the recent study, larvae of each species were force-fed to lambs. Some lambs received larvae of only one species, some got larvae of two species, and some larvae of all three species. About 3 months later, worms recovered from each lamb's stomach were counted and compared with the original number of larvae fed each animal.

If all three species were in a lamb's stomach, the population of one species, the large stomach worm (*Haemonchus contortus*), was drastically reduced. The population of another, the medium stomach worm (*Ostertagia circumcincta*), was moderately reduced. But the third species, the stomach hairworm (*Trichostrongylus axei*), per-

sisted as well or better with the others than when alone.

#### Large worm again was weak competitor

In the two-worm combinations, the large worm was again the weak competitor—based on comparisons of larvae fed and worms recovered. If large and medium worms were together, populations of both were smaller than when either was alone. Large worms were almost eliminated when tried with stomach hairworms, which did better in this combination than by themselves. Hairworms also thrived with medium stomach worms, which fared about as well alone or in combination.

The study was conducted by ARS parasitologists J. H. Turner, G. I. Wilson, and K. C. Kates. They worked at USDA's Parasitological Laboratory, Beltsville, Md.

Earlier experiments by Kates and Turner showed that other species may not compete with each other in sheep. Populations of the large stomach worm and the thread-neck worm (*Nematodirus spathiger*) were greater than when either species alone infested the animals.

The scientists also demonstrated that the same effects occurred when intestinal hairworms (*Trichostrongylus colubriformis*) and thread-neck worms infested sheep.☆

## PLANTING TO BOOST PLANTAIN PRODUCTION

■ USDA research has opened the way for needed expansion of plantain production on the steep mountain slopes of Puerto Rico and similar tropical areas.

Researchers demonstrated that yield of plantains (cooking bananas) can be almost doubled by growing 800 instead of the customary 500 trees per acre. The yield from 800 trees per acre was 9.5 tons of fruit, compared with 5.5 tons from 500 trees.

Increased production made possible by the higher planting rate could help densely populated Puerto Rico meet its food needs. A USDA survey in 1953 showed that Puerto Rico could use four times as many plantains as were being produced.

ARS soil scientists Jose Vicente-Chandler and Jacinto Figarella found that plants produced as well at the 800-plant rate as at the 500-plant rate. Yield per tree, bunch size, fruit size, and percent of trees bearing were not significantly affected by the closer spacing.

The research, in cooperation with the University of Puerto Rico Agricultural Experiment Station, also showed that complete land preparation and clean cultivation are not necessary for maximum plantain yields.

In their experiments, Vicente-Chandler and Figarella planted plantain corms in holes dug in undisturbed grass sod. They had killed top growth of the short grass with a heavy application of pentachlorophenol and oil, leaving an erosion-preventing mulch. The scientists cultivated to eliminate weeds in plantain rows but allowed volunteer grasses to grow between rows. All plots were heavily

fertilized and protected against insects, diseases, and nematodes.

Yields from sod plots planted at the conventional rate were equal to those from cultivated plots planted at the same rate. This indicated that competition from between-row grass did not reduce production.

Crop production on the mountain slopes of Puerto Rico has been restricted by erosion and the difficulty of using machinery. Intense tropical rains erode plowed soil on the slopes. Planting in sod lessens erosion, and equipment can be operated more easily.

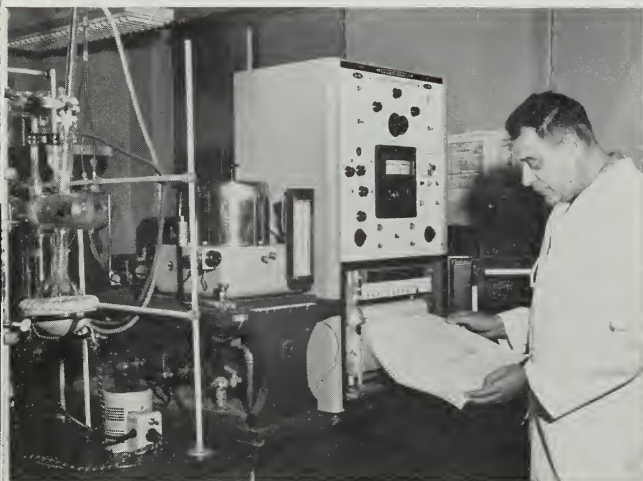
The scientists estimate that plantains can be grown in undisturbed sod on 400,000 acres of steep mountains in Puerto Rico that are not now used to produce food crops. And planting 800 corms per acre would give maximum yield on this soil, as well as on other land currently in plantains.☆

*Soil wasn't cultivated in plots of 800 trees per acre. Contact herbicide reduced grass growth.*



# Distinctive Flavors From FAT

*Hornstein uses gas chromatography to identify chemical components of meat aromas.*



*Carbonyls—compounds in fatty parts of beef, lamb, and pork—seem responsible for the way these meats taste after they are cooked*

■ It's the fatty portions of beef, lamb, and pork that give these meats their distinctive flavors. The lean portions all taste about the same.

These are conclusions of USDA chemists from basic research on meat flavors. Recent work on lamb seems to narrow down the substances responsible for its characteristic flavor to a class of compounds in the fat known as carbonyls.

The aroma of roast lean beef, pork, or lamb can be produced by soaking each meat in cold water, then freeze-drying the extract to a powder and heating it. But if no fat is present, the *kind* of meat producing the aroma cannot be identified, either by smell or by trapping the aromas given off and analyzing them for their chemical constit-

uents. When the fats of these meats are similarly heated, on the other hand, they give off distinctive odors. The chemical constituents of these aromas, while roughly similar, vary widely in proportions and amounts.

Chemists I. Hornstein and P. F. Crowe of the ARS Eastern utilization division, Beltsville, Md., are carrying out these experiments. They explain that isolating the flavor source of a food like meat, whose full flavor is developed only by cooking, is a two-fold operation. First, the chemists analyze the aromas given off by heated meat to determine the chemical components. Then they look for the aroma precursors—compounds in the raw meat that are converted by heating to the compounds responsible for the cooked flavor.

The chemists were especially interested in the strong mutton aroma obtained when they heated rendered lamb fat. Realizing the potentialities for increasing the consumer acceptance of lamb through modification of this flavor, the scientists began a search for its origin. Their suspicion was that the mutton flavor might be coming from some compounds broadly classified by chemists as carbonyls.

So they placed mutton aroma in contact with a chemical (2,4-dinitrophenylhydrazine) that reacts with carbonyls specifically. This removed the carbonyls and considerably reduced the mutton aroma. The experiment showed that carbonyls are at least partially responsible for the flavor.

Then Hornstein and Crowe analyzed the raw lamb fat to see if carbonyls present were the precursors of cooked flavor compounds. Fat was dissolved in hexane and treated with the same carbonyl-reacting chemical used before. About 97 percent of the fat was recovered carbonyl-free. Heating it produced no mutton aroma.

All carbonyls in the fat, converted to another form by the reactant, were present in the remaining 3 percent. This fraction was analyzed first for total carbonyls, then for individual carbonyls. The chemists have not yet identified all carbonyls the first test indicated were present. Carbonyls identified were not of the types that would account for lamb flavor.

Thus, the specific chemical components of lamb responsible for its mutton flavor have so far escaped positive identification. The researchers believe, however, that the flavor components are among the unidentified carbonyls. Hornstein and Crowe are working to precisely identify these carbonyls.☆

## Wilder medal awarded to ARS unit

The Wilder Silver Medal for "leadership in developing virus-free strawberries" has been awarded to the small fruit investigations unit of ARS. This award is given by the American Pomological Society.

The highest award of the society, the Wilder medal was established in 1873 and is given annually in recognition of outstanding work in horticulture.

Until this accomplishment by the USDA scientists, viruses plagued strawberry growers in North America. Growers could not obtain any virus-free plants of certain varieties.

The researchers also developed methods of keeping stock virus-free while it is increased. As a result, many nurseries are now able to supply virus-free strawberry plants. Virus-free plants produce more and better berries and have a longer productive life than infected plants.

Most of the important strawberry-producing States have set up virus-free certification and improvement programs.

## Turkey study results in saving

A saving of \$200,000 a year by the turkey industry is the net result of a short-term study conducted by USDA investigators.

They found that some turkeys apparently infected by visceral lymphomatosis—a form of avian leukosis—but actually infected by blackhead disease, were being condemned during processing.

Federal inspectors at processing plants must condemn birds with leukosis. But if birds have any of several other diseases, including

blackhead, only the infected parts must be discarded.

An unusually large number of turkeys being condemned due to leukosis in some areas alerted AMS poultry pathologists G. S. McKee and F. C. Love. They checked some processing plants and found that birds having peculiarly nodulated spleens were being condemned. This is a leukosis symptom, but can be mistaken for blackhead.

McKee and Love were aided by ARS research zoologist A. M. Lucas



and biologist E. M. Denington. They discovered that nodulated spleens—if there is no evidence of leukosis in other parts of the turkey's body—result from reactions to blackhead, not to visceral lymphomatosis.

The scientists say blackhead can usually be recognized when livers have distinctive lesions. But these might be absent if diseased birds are given blackhead-combating drugs. So the only evidence of disease may be a nodulated spleen that appears leukotic. When spleens are leukotic, other organs will also indicate the presence of leukosis.

McKee and Love are stationed in Washington, D.C. Lucas and Denington work at East Lansing, Mich.

## Inbred dent corn lines released

Two new inbred lines of dent corn, Mo 12 and Mo 13, have been released by USDA and the Missouri Agricultural Experiment Station.

Plant breeders use inbred lines as parent stock in developing hybrids.

The lines are selected for the desirable characteristics they impart to the hybrids.

In single- and three-way crosses with other inbreds, Mo 12 and Mo 13 have produced offspring with superior yield performance. Mo 12, has very dark green leaves and pale yellow kernels. It shows good resistance to leaf-firing during drought. Mo 13 has good resistance to lodging, and better than average earworm resistance. Both inbred lines are late-maturing strains adapted to growing conditions in Missouri and other States in similar latitudes.

These inbreds were developed by ARS agronomist M. S. Zuber at the Missouri station.

Hand-pollinated seed of Mo 12 and Mo 13 is available from the Foundation Seed Stocks Project, 108 Waters Hall, Columbia, Mo.

## Gains from earlier peach thinning

USDA studies have confirmed the value of thinning fruits of early ripening peach varieties soon after bloom to increase fruit size. The research also shows that earlier thinning leads to earlier ripening of peaches, a heavier bloom, and a bigger yield the next year.

Most previous investigations on affect of time of peach thinning were done with Elberta, a late-ripening variety, and effects other than increased fruit size were inconsistent. To get more information on response of early ripening varieties to time of removing immature fruits, ARS horticulturist A. L. Havis conducted tests in a Redhaven peach orchard at Beltsville, Md.

Earliest thinning was done at bloom. Later thinnings, at 2-week

## AGRISEARCH NOTES

intervals, were made until about 10 days before the first harvesting date.

Peaches on trees thinned earliest ripened earliest. Fruit size and yield were increased substantially in trees thinned up to 8 weeks after bloom, but were greatest on those thinned earliest. These effects are more evident with Redhaven than with late-ripening peach varieties.

Trees thinned within a month after bloom had good bloom the next season, but those thinned just before



harvest had only 40 to 50 blossoms per tree the next year.

Time of thinning does not seem to affect fruit flavor, texture, firmness, or skin color.

### USDA introduction is good parent

A sweetpotato brought to this country by USDA in 1946 is the source of disease resistance in Nugget, a new variety developed by scientists of the North Carolina Agricultural Experiment Station.

Nugget may replace disease-susceptible Porto Rico, the major commercial variety of sweetpotatoes grown in the U.S. The new variety produces good yields and resists internal cork and wilt. Nugget's high-quality tubers have orange flesh.

The sweetpotato used to develop

Nugget was found on Tinian Island, one of the Marianas in the Pacific. After 2 years of testing in this country, this introduction showed great promise as a source of resistance to stem rot (wilt) disease. It was released to plant breeders in 1948 as a source of disease resistance.

### New pioneering laboratory in Ohio

Research in a new USDA laboratory at Wooster, Ohio, is aimed at developing basic knowledge that may lead to improved methods of applying pesticides and fertilizers, or help to reduce air pollution.

At this Pioneering Research Laboratory on the Physics of Fine Particles, ARS agricultural engineer R. D. Brazee is studying the formation and physical behavior of finely divided liquid and solid particles.

He hopes to develop mathematical descriptions of fine particles, and to devise equipment for measuring their movement as aerosols (droplets of liquid suspended in air). Brazee will also measure the influence on particles exerted by forces such as temperature and wind, and study factors affecting these forces.

The pioneering laboratory is housed at the Ohio Agricultural Experiment Station.

### Award won by USDA chemist

Allene R. Jeanes, a chemist of the ARS Northern utilization division, Peoria, Ill., is one of six Government

career women and the first in USDA to receive the Federal Woman's Award.

The award cites "her pioneering chemical research on the starches and sugars obtained from cereal grain."

The Federal Woman's Award, given for the first time last year, is the only honor exclusively for career women in the Federal Government.

Dr. Jeanes won the award for her sustained contributions to the chemistry of microbial polysaccharides, including a prominent part in developing dextran, a product of sugar



fermentation used as a blood plasma extender. This material, of particular value to the Armed Forces and civil defense when large quantities of plasma are needed, alleviates shock by stopping excessive movement of water from blood to body tissues.

For her work on dextran, Dr. Jeanes also has won USDA's Distinguished Service Award and the Garvan Medal of the American Chemical Society for distinguished service to chemistry by a woman scientist.